

CLAIMS

1. A photolithographic mask to transmit light, comprising:
a transparent substrate;
a native oxide-free, elemental metal, first layer to attenuate the light; and
5 a second layer to impart a phase delay on the light, one of the first layer and the second layer disposed on the substrate, and the other of the first layer and the second layer disposed on the one of the first layer and the second layer.

10 2. The photolithographic mask of claim 1, wherein the first layer is substantially amorphous.

15 3. The photolithographic mask of claim 1, wherein the light is at least partially coherent light and has a wavelength of less than 248 nm.

4. The photolithographic mask of claim 1, wherein the first layer is platinum.

15 5. The photolithographic mask of claim 1, wherein the first layer is palladium

20 6. The photolithographic mask of claim 1, wherein the first layer and the second layer combine to impart a phase delay of one-half of a wavelength of the light.

7. The photolithographic mask of claim 1, wherein the second layer is a spin-on glass.

25 8. The photolithographic mask of claim 7, wherein the second layer is a substantially carbon-free material.

9. The photolithographic mask of claim 8, wherein the second layer is Hydroxy Silsesquioxane.

30 10. The photolithographic mask of claim 1, wherein the first layer is disposed on the substrate.

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11. A photolithographic mask to transmit light, comprising:
a transparent substrate;
a platinum first layer to attenuate the light; and
a second layer to impart a phase delay on the light, one of the first layer and the

5 second layer disposed on the substrate, and the other of the first layer and the second
layer disposed on the one of the first layer and the second layer.

12. The photolithographic mask of claim 11, wherein the first layer is substantially
amorphous.

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13. The photolithographic mask of claim 11, wherein the first layer and the second
layer combine to impart a phase delay of one-half of a wavelength of the light.

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14. The photolithographic mask of claim 11, wherein the second layer is a spin-on
glass.

15. The photolithographic mask of claim 14, wherein the second layer is a
substantially carbon-free material.

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16. The photolithographic mask of claim 15, wherein the second layer is Hydroxy
Silsesquioxane.

17. The photolithographic mask of claim 11, wherein the first layer is disposed on the
substrate.

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18. A method for forming a photolithographic mask to transmit light, comprising:
providing a transparent substrate;
depositing a native oxide-free, elemental metal, first layer; and
depositing a second layer upon the first layer, one of the first layer and the second
30 layer disposed on the substrate, and the other of the first layer and the second layer
disposed on the one of the first layer and the second layer, wherein the first layer
attenuates the light, and wherein the second layer imparts a phase delay on the light.

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19. The method for forming photolithographic mask of claim 18, wherein the first layer is platinum.

20. The method for forming photolithographic mask of claim 18, wherein the first 5 layer is palladium.

21. The method for forming photolithographic mask of claim 18, further comprising chemically etching the second layer.

10 22. The method for forming photolithographic mask of claim 19, further comprising ion milling the first layer.

23. The method for forming photolithographic mask of claim 22, wherein the 15 chemical etching and ion milling steps are performed using the same ions.

24. The method for forming photolithographic mask of claim 23, wherein the ion 20 milling and chemical etching are performed using CH₃ ions.

25. The method for forming photolithographic mask of claim 22, wherein the ion 25 milling is performed using argon ions.

26. The method for forming photolithographic mask of claim 24, wherein the chemical etching and ion milling occur in the same processing chamber of an ion processing apparatus.

25 27. The method for forming photolithographic mask of claim 18, wherein the first layer is disposed on the substrate.

30 28. A photolithographic system, comprising:
an at least partially coherent light source to produce light; and
a photolithographic mask to transmit the light, comprising a transparent substrate,
a native oxide-free, elemental metal, first layer, and a second layer to impart a phase
delay on the light, one of the first layer and the second layer disposed on the substrate,

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and the other of the first layer and the second layer disposed on the one of the first layer and the second layer.

29. The photolithographic system of claim 28, wherein the light is at least partially
5 coherent light and has a wavelength of less than 248 nm.

30. The photolithographic system of claim 28, wherein the first layer is substantially
amorphous.

10 31. The photolithographic system of claim 28, wherein the first layer is platinum.

32. The photolithographic system of claim 28, wherein the first layer is palladium.

15 33. The photolithographic system of claim 28, wherein the first layer and the second
layer combine to impart a phase delay of one-half of the wavelength of the light.

34. The photolithographic system of claim 28, wherein the second layer is a spin-on
glass.

20 35. The photolithographic system of claim 34, wherein the second layer is a
substantially carbon-free material.

36. The photolithographic system of claim 35, wherein the second layer is Hydroxy
Silsesquioxane.

25 37. The photolithographic system of claim 35, wherein the first layer is disposed on
the substrate.